

Goal 4

Key Theme - Biological Control

Wyoming

Impact – All signs indicate that the biological control program against leafy spurge will be a major success. These results, combined with the ready availability of the two flea beetle species, have stimulated interest among private and public land managers. With considerable effort on the part of county weed and pest personnel, over 6 million flea beetles were collected and moved to other sites in Wyoming. Also in 2000, another 16.5 million flea beetles were collected and moved to sites in Montana, Wyoming, and the Dakotas through a collaborative effort involving private, local, state, university, and federal entities. The long-term benefit-cost ratio has been estimated by some to be as high as \$31 for each \$1 invested.

Washington Research

(2) Biocontrol agent deployments in WA have contributed to enhanced exotic weed suppression and have led to diminished herbicide inputs of 50% or more in forest, wetland, and rangeland/pasture ecosystems.

Washington Extension

b. Impact: Over 63,000 insects were redistributed for Diffuse and Spotted Knapweed, St. Johnswort, and Dalmatian Toadflax on over 136 new sites across Okanogan, Ferry, Stevens, Pend Oreille Counties, and the Colville Reservation. Characteristics recorded for these sites and mapped using a Geographical Positioning System are entered in a database for future monitoring and evaluation. Biocontrol adoption lead to a 25-30 percent reduction in herbicide applications on targeted knapweeds, with a much larger long-term reduction with reduced rate of spread of the invasive species. This will result in substantial weed control expenditure savings in the four counties and improved environmental quality. Effective bioagents for Dalmatian Toadflax, Houndstongue, and Orange and Yellow Hawkweed have been identified by the collaboration as top priorities for future procurement and breeding in cooperation with Extension faculty. Biological adoption has led to a 25-30 percent decline in herbicide applications to control knapweed and yellow starthistle, resulting in financial savings and improved environmental quality. The overwhelming positive response of the residents and agencies within the Quad County/Colville Reservation area and on a statewide basis shows the need for continuation of this project.

New Jersey Combined Research and Extension

Activity: Domestic production of fruit, vegetable, herb, turf, ornamental, and other specialty crops are estimated to be worth over \$40 billion dollars annually (1997 Census of Agriculture). In New Jersey, 89% of the farm gate value of crops are from high value, low acreage horticultural crops. Producers of these crops (collectively called minor crops) have numerous problems with insect, disease, and weed pests that can cause a significant reduction in farm gate value. Due to high costs of research and development, the basic producers of crop protection

chemicals often do not extend legal registrations of their products into these high value, low acreage specialty crops.

USDA has established Interregional Research Project Number Four (IR-4) as the national program to support the registration of chemical and biological pest control tools for minor or specialty crops. This program is a partnership between USDA and the State Agriculture Experiment Stations. The IR-4 Project is administered from its National Headquarters at Cook College/New Jersey Agricultural Experiment Station, Rutgers-The State University of New Jersey.

IR-4 relies on commodity producers, state and federal research scientists and extension personnel to identify pest control needs and potential solutions to the problem pest on the minor crops. These needs are evaluated by the potential registrant of the chemical and/or biological pesticide, by the U.S. Environmental Protection Agency (US-EPA), and by committees of minor crop pest control experts. Once priority research projects are identified, IR-4 will provide coordination, funding and scientific guidance for both field and laboratory research to develop the appropriate data to support the registration by US-EPA. Without the assistance of IR-04, few safe and effective chemical and biological pesticides would be available for use on minor crops.

For the past five years IR-4 has focused it's research efforts to pest control tools, which are considered reduced risk. These new pest control tools, when used properly, often have very low toxicity and hazard to humans and the environment, and have the potential to serve as suitable substitutes to chemicals that are vulnerable to cancellation from US-EPA implementing the Food Quality Protection Act of 1996. In 2000, IR-4 funded 175 research projects consisting of 138 reduced risk chemicals and 37 biological pest control agents. In addition, IR-4 performed over 600 field trials.

Impact: In calendar year 2000, IR-4's efforts facilitated the regulatory clearance of 511 clearances on food crops and 56 biopesticide clearances. Since 1963, IR-4's research efforts have developed data that supports over 5,500 used on food crops, over 8,800 on ornamental crops and over 200 biopesticide clearances.

Source of Funding: Hatch, CSREES, Special Grant, Private Grant

Scope of Impact: Multistate Integrated Research and Extension all 50 states

Key Theme – Integrated Pest Management

Wyoming

Researchers and Extension educators at University of Wyoming are conducting studies to develop and evaluate integrated pest management systems. The primary focus of this research is to reduce the application of pesticides and enhance biodiversity of the natural resource. For example, the Reduced Agent-Area Treatments (RAATs) is a method of integrated pest management for rangeland grasshoppers in which the rate of insecticide is reduced and untreated swaths are altered with treated swaths. This IPM approach allows predators and parasites to be preserved in untreated swaths and dramatically reduces the amount of insecticide applied and the cost of control.

Impact – Results from the integrated pest management studies being conducted will impact crop production and range management across the west. For example, to apply some figures to the RAATs method of control for rangeland grasshoppers, one county in Wyoming has treated 60,000 acres of rangeland for grasshoppers the last two summers. Savings from the RAATs method versus value of forage loss with no control was \$78,000 versus the traditional treatment, the savings with RAATs was \$99,600. The percent reduction in insecticide used with RAATs was 62 percent (dimilin) and 99 percent (carbaryl). The RAATs method is being actively adopted in surrounding states with reports of programs in Idaho, Montana, Oregon, South Dakota, and Utah.

Wisconsin Research

The issue: Wisconsin ranks third in the nation in potato production. The Food Quality Protection Act has prompted a review and possible elimination on many chemicals used to control diseases and insects that attack the traditionally pesticide-intensive crop. Growers are looking for new, environmentally sensitive ways to control pests and remain competitive.

What's been done: Three year's of UW-Madison research on Quadris -- a new fungicide that is less toxic and used in smaller amounts than previous compounds -- accelerated U.S. Environmental Protection Agency evaluation of Quadris, which it approved in 1999. Entomologists found that planting potatoes a quarter mile from the previous year's potato fields reduced Colorado potato beetle problems by 85 percent. They also showed that new, reduced-risk pesticides would control potato beetles while leaving beneficial wasps in place to control aphids that attack the crop.

The impact: The research has helped growers reduce chemical use, adopt less toxic compounds and rely more on cultural practices and biologically based methods to keep pests in check. In 1999, for example, the approval of Quadris allowed growers to control early and late blight while applying half as much fungicide as they use in 1998. With Quadris, Wisconsin growers got improved blight control -- which led to an increase in yield valued at \$17 million statewide -- for almost the same cost as traditional fungicides. In Central Wisconsin, growers with fields scattered across tens of thousands of acres now minimize potato beetle problems by coordinating when and where they plant potatoes.

Washington Research

The development and use of models in IPM improves the timing of pesticides and the efficiency of sampling by crop consultants. *L. subjuncta* is a pest on about 40% of WA fruit acreage and a potential pest on all acres and crop losses as high as 30% have been reported by individual growers. The degree-day model for *L. subjuncta* will allow growers to use more selective insecticides and reduce the number of chemical control applications from 2 to 1. *This could save WA fruit growers over \$2 million per year (\$30/acre times 68,000 acres).*

The use of pheromones for insect management in WA has reduced broad-spectrum pesticide use by 75% in many apple orchards. The development of aggregation pheromones as a monitoring tool and

potentially a control strategy for stink bugs will reduce crop losses from this pest group that is a major threat to “soft” pest management programs.

Annually updated pest management recommendations are adopted by tree fruit growers thus saving growers money

Washington Extension

b. Impact: Wheat growers in the intermediate rainfall areas adopted the use of seed treatment insecticides during early fall planting to control aphids on an estimated 15,000 acres in the Tri-County Area of Whitman, Garfield, Asotin with estimated returns from increased yield of over \$200,000. 1500 wheat producers seeded WSU/WSCIA tested locally adapted varieties on 645,000 acres of wheat and 300,000 acres of barley in the Tri-County area for an average yield increase of ten bushels per acre. This increase is valued at over \$20 million returned to the local economy because of information received by the team at meetings, tours and direct piece mailings. 275 individuals increased knowledge about pulse (dry pea) insect control using “soft” chemicals and expressed support for registration of new products. On Farm Testing research accelerated adoption of seed treatment insecticides use and experimentation in both cereal grains and pulse crops. This is enhancing the adoption of Integrated Pest Management into farming systems and is providing public and private research scientists with increased awareness of the potentials for incorporating newer classes of insecticides that are environmentally safer and provide minimal exposure to applicators. “Soft” classes of chemicals were shown to have equal efficacy and will be able to supplant the use of older classes of insecticides that are being closely scrutinized by provisions of the Food Quality Protection Act. On farm testing malting Barley trials at five locations in eastern Washington resulted in evaluations of a new cultivars by Great Western Malting, which can be utilized by the malt industry and provide economic incentives to producers. These trial results provided producers in the intermediate rainfall zones of eastern Washington the potential for 15,000 more acres of malting barley to be planted with an estimated gross market value of over \$1 million.

Tennessee Combined Research and Extension

Impact::

The cotton IPM program offers producers an educational scouting and management service which deals with primary yield limiting factors. Producers on the program receive a weekly comprehensive report regarding these pests and a weekly letter related to pest problems.

Established a spring boll weevil trapping program. The trapping program information was beneficial in predicting overwintered survival rate and provided support for U.T. pin-head square recommendations.

According to the latest cotton producer survey, 86% of cotton producers are using some degree of IPM practices which has resulted in pesticide reduction by an average of 31%. This represents a savings of approximately \$882,217.58 for Lauderdale County cotton producers or \$19.72 per acre.

Seventeen (17) Lauderdale County cotton producers enrolled approximately 6,717 acres in the cotton IPM program. Results from the program pointed out that 67% of the acres on the program needed at least one treatment for thrips, 72% reached the treatment level due to boll weevil conventional damage and 4% of the acres on the program needed treatment due to bollworm/budworm pressure. Also, 11% of the total acres on the program reached threshold levels due to plant bugs, 12% of the acres reached treatment levels due to aphids and 1% of the acres were treated for stinkbugs.

Funding Source:

Smith-Lever (3d and 3b&c) and State

Scope:

State Specific

Puerto Rico Extension

Two thousand three hundred and fifty five (2,355) farmers adopted the use of integrated pest management in starchy crops, vegetables, plantain, coffee, fruits, and pineapple.

New York Combined Research and Extension

Copper Bands Prevent Economic Losses from Snails in Grapes

In some parts of the Finger Lakes and in Niagara County—and across Lake Ontario in Canada--striped snails have lately taken to clambering around in grape canopies just at harvest time. While it appears they eat neither leaves nor fruit, these snails can still cause extreme economic hardship for grape growers. The effect of striped snail is like that of hail—it may not hit often, but when it does it can mean a total loss. For if one snail turns up as a processor samples the load—as has happened each year since 1998—the company will reject a grower's entire lot of grapes.

It seems likely that the snails were always in the canopies during summer months, but went back to the ground as temperatures dropped in the fall. Perhaps it's the milder winters and warmer growing seasons of late that have kept the snails on the vines into the harvest season. Now the challenge is to keep the snails off the vines entirely. Tim Martinson of the Finger Lakes Grape Program has researched a variety of insecticides, baits, mechanical controls, and fungicides. He has found that barriers made of copper strips are 100% effective in preventing snails from moving into the grape canopy. Although the initial expense for materials and labor is high, the barriers should provide excellent control for several years at virtually no risk to the environment.

The wholesale price on a truckload—20 bins—of grapes is \$5,400, so a grower who has their entire load rejected because of a snail in one bin stands to lose a lot. Martinson estimates that materials and labor cost to install copper strips on an acre (600 vines) of grapes would cost approximately \$80 per acre and would last five years. (By comparison, spraying copper fungicides at the base of the vines to deter snails would cost roughly \$20 per acre per year.)

New Jersey Combined Research and Extension

Key Themes: Integrated Pest Management

Plant Germplasm

Home Lawn and Gardening

Activity: The purpose of this multidisciplinary research and extension program, which contributes to Multistate Research Project NE-187, "Best Management Practices for Turf Systems in the East," is to aid golf course superintendents in the selection of improved bentgrass cultivars that will require reduced fungicide inputs. It focuses on the disease response of several new bentgrass cultivars maintained under different nitrogen fertility, mowing height, and fungicide regimes. Three common foliar diseases were

evaluated – dollar spot, brown patch, and copper spot.

Impact: The total number of fungicide applications used on this study in 2000 was reduced 75 to 88% for improved bentgrass cultivars compared to the most susceptible cultivar to dollar spot. From this research, it is apparent that many of the new bentgrass cultivars can be used to reduce fungicide inputs while maintaining acceptable turf quality. For most cultivars, dollar spot was most severe on turf receiving the low rate of nitrogen and the lower height of cut. Brown patch was most severe on turf maintained at greens height and high nitrogen, while a high incidence of copper spot was only seen on one of the new cultivars.

Source of Funding: Hatch, State Funds and Private Grant

Scope of Impact: Multistate Integrated Research and Extension (CT, FL, ME, MD, MA,)

New Jersey Combined Research and Extension

Activity: An Extension program was planned and executed to address environmental issues of significant concern to residents of the Delaware Valley where ornamental landscape plantings including turfgrass are a dominant ecological feature. Landscape managers, including professionals and homeowners, rely heavily on chemicals for maintenance. As a result, pesticides and fertilizers are sometimes misused presenting risks to humans and to the environment. Water use is also a priority concern. Liberal water use threatens limited groundwater aquifers. Many believe that increasing water use is depleting groundwater aquifers at a rate that exceeds natural replenishment. This program addresses these and related environmental and health concerns by increasing awareness and adoption of sustainable landscape management practices by commercial and consumer horticulturists.

Twenty-eight educational lectures were presented to approximately 650 professionals, homeowners and Master Gardeners at 18 educational meetings offered locally. Thirteen articles were published in statewide newsletters. Additionally, approximately 5,000 consumers and professionals requested assistance with lawn and ornamental plant problems.

In another county, a mentoring program was established by RCE to educate professional landscape contractors about adopting a complete IPM program. Each month during the growing season, an extension program associate met one-on-one with the landscapers on their customers' properties. Mentoring sessions assisted with diagnosing landscape problems, demonstrating monitoring skills and record keeping, answering questions, encouraging appropriate pest control decisions, and reinforcing IPM concepts.

Impact: Overall, educational outreach (including meetings, newsletters, publications and individual publications) reached 21,000 plus contacts. An additional 150,000 Camden County residents were reached through a mass mailing, in collaboration with the Camden County Municipal Utilities Authority. Evaluation results confirmed that program efforts achieved the objectives to increase IPM understanding, improve diagnostic skills and adoption of IPM practices on at least 7,500 acres of residential, commercial and public landscapes. Evaluation data revealed adoption of environmentally sensitive lawn and landscape practices on 10,200 acres of residential, public and commercial landscapes.

Commercial landscapers in the IPM Mentoring program reduced their pesticide use by 42 percent, and increased their use of natural, biological pesticides. Sixty percent of program participants now use some IPM practice in their business, and 100 percent plan to incorporate IPM into their customer marketing.

Thirty percent of participants have adopted a total IPM approach and 100 percent of those who were mentored are using IPM methods. Cooperating commercial landscapers sprayed 92 percent fewer plants after completing the IPM mentoring program. By the season's end, pesticide use had decreased 40 percent (from 240,000 gallons before the program to 144,000 gallons using IPM)

Source of Funding: Smith-Lever 3(b) & (c), State Funds, Camden County Board of Freeholders

Scope of Impact: State Specific

New Hampshire Extension

Cooperative Extension's Integrated Pest Management (IPM) program teaches a combined approach to pest problems, rather than relying on a single pest reduction method.

Monitoring populations of pests, beneficial insects, or weather conditions is a key component. Pest prevention techniques are also important, like rotation, destruction of crop residues, and preservation of biological control agents. Direct controls (like spraying) are recommended only when field monitoring indicates it is needed. Growers learned to use insect traps, hand lenses to identify predator mites, and equipment to compute degree days. A 24 hour a day telephone for fruit growers gives callers a pre-recorded message about current pest conditions and is changed every Tuesday, April 1-Sept. 15.

- a. Impact - For 2000, IPM program economic impacts were estimated at \$480,000; a \$400,000 reduction in spraying apples (compared to pre-IPM levels), and an \$80,000 increase in apple profits from reduced pest injury on an 850,000 bushel crop. Using a grant from NH's Dept. of Agriculture, UNH Cooperative Extension monitored rootworm numbers in 129 fields in six of New Hampshire's 10 counties. Growers were shown that rootworm numbers were low; in most cases far below levels that would require treatment, saving a number of growers from needlessly applying soil insecticides. Field corn insecticide application was eliminated on 600 acres (783 lbs a.i. of insecticide), for a \$12,000 savings, mostly in one of New Hampshire's largest counties, Hillsborough County. For strawberries, there was a \$25,000 savings to growers, from reduced tarnished plant bug injury. *Peristenus digoneutis*, a tarnished plant bug parasite UNH Cooperative Extension introduced in 1991, has now spread throughout the state and is significantly reducing TPB numbers in alfalfa. It also attacks some TPB's in strawberries. *Typhlodromus pyri*, a predator mite UNH Cooperative Extension introduced in 1996, is now established in several apple orchards. UNH Cooperative Extension plans to spread this predator to several new orchards for each of the next three years. Once this predator is established, the grower won't need to apply any chemicals to control European red mite, a major apple pest. The reduction in pest control costs and pest injury have resulted in higher profits for farmers. This has been particularly important for apple growers, facing tougher competition and lower prices for their fruit.
- b. Source of Funding - Smith-Lever 3b&c, State Matching Funds
- c. Scope of Impact - Multistate Extension (NH, MA, ME, CT, RI, VT)

North Carolina Research

North Carolina apple growers must find alternatives to the organophosphate insecticides they have relied

on for more than 30 years to protect their crops. It appears likely that government regulatory action will reduce the availability of organophosphate insecticides, and buyers of processing apples are concerned about pesticide residues on apples. Gerber Products Company, a major buyer of apples in North Carolina, informed growers in November 1999 that the company would not purchase apples treated with organophosphate insecticides beginning in 2000. Research and extension programs at North Carolina State University focused on biorational methods of insect control. Methods include pheromone-mediated mating disruption and new pesticides that must be used in an entirely different manner than the insecticides growers have been using. On-farm research demonstrated that new technology can be used to significantly reduce the use of organophosphate insecticides. A partnership between NC State University, the North Carolina Apple Growers, the pesticide industry, and Gerber was formed to oversee the successful implementation of a reduced-risk management approach on 1,000 acres of North Carolina apples in 2000. With the aid of a USDA Pest Management Alternatives Program grant, the project will be expanded to include additional processing and fresh market growers in 2001.

- d. Impact - The successful implementation of this program has allowed North Carolina apple growers to maintain a critical market for processing apples and enabled them to remain competitive on national and state markets.
- e. Source of Funds - Hatch, State and Smith-Lever
- f. Scope of Impact - Regional

Arkansas 1862 Research

A peach IPM program has been established and is in use by Arkansas peach producers. A weekly newsletter and web site keeps farmers posted on pest populations and updates them on new research based recommendations.

Impact - Growers utilizing the program have reduced pesticide use by up to 50%. Use has increased from an initial four acres to over 200 acres annually.

Source of federal funds - Hatch, state matching, regional IPM grants program

Scope of impact - Multistate research and extension in AR, OK

Arizona Combined

a. An integrated pest management program implemented two new tools in 1997 and continued their use in 1998: insect growth regulators (IGRs, effective against whiteflies) and transgenic cotton. The UA College of Agriculture and Life Sciences collaborated with growers, the USDA, the Arizona Department of Agriculture, the Arizona Cotton Growers' Association, Cotton Incorporated, and others. Both of these tools are highly effective against pests, but safe to humans and the environment. Based on insect hormones, growth regulators disrupt the growth and development of insects. Transgenic cotton is genetically engineered to carry its own biological insecticide, targeting lepidopterous pests, within the plant tissues.

b. Impact - As a result of this program, during 1999 the average foliar insecticide use in Arizona cotton was the lowest in 20 years, according to state records first kept in 1979. Overall, 1999 have the lowest number of foliar sprays against all insect/arthropod pests in cotton during the 90s, and the lowest costs per acre during the same period. In 1990, growers applied about 11 sprays during the season at an average cost of \$113.76. By 1999 this number had dropped to 1.74 (between one and two sprays) at an average cost of \$34.50. For silverleaf whitefly (SWF) in particular, the number of sprays dropped from 1.80 per season in 1992 to 0.40 for the season in 1999. Lint quality went from "very sticky" in 1992 to "very clean" in 1999. In 1992 SWF sprays cost an all time high of \$91.80 per acre, and amounted to nearly 75% of the total foliar insect control budget. By 1999 growers spent an average of \$10.83 per acre on SWF, which was only about 30% of the total foliar insect control budget. This was the lowest amount of money per acre spent to control SWF since its introduction to the state in the early 1990s. This success was mainly due to the efforts of the Arizona IPM program and the availability of IGRs and transgenic cotton in reducing the number of insects that appeared. Weather patterns and other factors may also have influenced the appearance of fewer numbers of insects in 1999. Annual cotton acreage in Arizona is usually over 250,000 acres. Along with resistance management, these IPM efforts reduced insecticide use, conserved biological control agents, and enhanced sustainability and profitability. The availability of these selected technologies, which are harmless to predaceous insects, has provided growers the opportunity to employ IPM practices that enhance the population levels of beneficial insects in the field.

c. Source of Federal Funds - Hatch Act, Smith-Lever 3(b) and (c), Special Research Grants, Smith-Lever 3(d)

d. Scope of Impact - Regional

Maine Research

The MAFES long-term experiment to develop ecological pest and soil management systems for potatoes in Maine has finished its 10th growing season. This project is designed to provide information on the costs, productivity, and environmental impacts of alternative cropping strategies for potato. A pest management system using integrated pest management and synthetic pesticides is compared to a more biologically oriented system. A soil management system centered on chemical fertilizer use is compared with one that relies heavily on manure and soil organic matter.

Impact — Results from this experiment are showing that reduced reliance on chemical fertilizers and pesticides does not have to mean reduced yields. Comparing environmentally friendly pest management tools with synthetic pesticides, researchers found that while both types effectively controlled Colorado potato beetles and leaf diseases, the environmentally friendly system resulted in a 62% reduction in total active pesticide ingredients with no significant reduction in yield. Research on soil management systems found that by amending the soil with manure (90 Mg/ha), they were able to reduce chemical fertilizer rates substantially, and yields in the plots amended with manure were significantly higher than those in the non-amended plots.

Source of Federal Funds — Hatch

Scope of Impact — State Specific”

Maine Extension

A Change in Weed Management Strategies: One key educational program that has been vital to improving pesticide detections in groundwater is the increased use of cultivation. Out of 57 growers surveyed at the 2000 Agricultural Trades show, 66 percent of the respondents are regularly using some cultivation in their work. The specific use reductions are as follows:

- Twenty-five percent have cut herbicide application by half.
- Twenty percent have cut herbicide application by one third.
- Thirty percent have cut their herbicide application by one quarter.
- Only 10 percent of those with cultivators do not use them.

While cultivation costs money, growers are, in effect, paying themselves for their time instead of giving money to the pesticide industry. Most importantly, this represents a significant reduction in pesticide use. This increased use of cultivation to reduce or replace herbicides is likely part of the reason why pesticide detections in groundwater near cornfields have dropped to zero in 1999.

Scope of Impact: Integrated Research and Extension

Key Theme - Nutrient Management

Wisconsin Extension

Over 300 farmers in numerous counties completed the nutrient management education program sponsored by UW-Extension. Pre-test and post-test scoring showed farmers gained an understanding that over three-quarters of them were over-applying nitrogen.

Key Theme - Environmental Public Policy

Washington Research

1. Research on resource and environmental economics was particularly important in the policy arena of conflicting agricultural and environmental interests.
2. Public policy makers were educated about the economics of alternative state water laws aimed at protecting traditional rights and providing more water for new uses.
3. Research on the value of reducing particulate pollution fed into policy about incentives-based conservation practice.
4. Research on soil conservation and particulate pollution from agriculture generated considerable controversy and helped inform regional policy decisions.
5. Water economics research helped shape the course of regional discourse about water, irrigation, hydropower, and fish.
6. Research on rights-based fishing has been credited by external sources with changing the course of national seafood policy, specifically modifying the American Fisheries Act, with enormous financial implications.

Key Theme - Soil Quality

Washington Research

Precision farming tools and refinement in remote sensing, Global Information Systems, and Global Positioning Systems have increased the efficiency of fertilizer and pesticide use and increased economic return.

Reduced tillage through direct seeding and reduced tillage has reduced our dependence on summer fallow and reduced soil erosion and air pollution through the STEEP and PM-10 programs.

Dissemination of information through bulletins, conferences, workshops, tours, case studies, and www information has informed our clientele of the most recent advancements in technologies for crop improvement, soil management, and marketing potential.

New Jersey Combined Research and Extension

Activity: Rutgers faculty have developed several promising biological remediation technologies for soils. Phytoremediation uses certain varieties of plants to accumulate toxic metals such as chromium, lead, and cadmium from contaminated soils. A related technology uses hydroponic plant cultures to remove toxic metals from water. This technology was developed through an integration of talents involving plant physiologists, biochemists, plant breeding experts, soil scientists, ecologists, agronomists, and molecular biologists.

A second environmental technology uses a sequential treatment process for remediation of soils impacted by hydrophobic hydrocarbon contaminants. This technology will be of immediate relevance and applicability to the gas and electric utility industries as owners of former manufactured gas plant sites with soils contaminated with coal tar residues. The technology will also be applicable to wood treatment sites contaminated with creosotes, to coke plant sites, to gas works sites contaminated with gas condensate residues, and to petroleum refineries and petroleum storage facilities (such as tank farms) that have been contaminated with heavy oil fractions. In addition, this technology could be used for treatment of media contaminated by other highly hydrophobic compounds, such as sediments contaminated with PCBs, chlorinated dioxins and dibenzofurans, or soils contaminated with DNAPLs such as chlorinated solvents.

Impact: Phytoremediation technology is being used to clean up the site of the former Magic Marker plant in Trenton. It has also been used to help redress severe contamination near the site of the Chernobyl nuclear disaster. Development of phytoremediation led to a spin-off company. In addition to its obvious value to the environment and “green industries,” phytoremediation has potential to provide New Jersey farmers with new, value-added crops to cultivate, thereby increasing productivity and profits for an industry with extremely narrow profit margins, and makes previously-contaminated land available for development or agriculture.

Because of the tremendous need for more effective approaches to remediate soils contaminated with highly hydrophobic organic contaminants, the sequential treatment process has attracted a great deal of industrial interest, particularly among the electric and gas utilities. In addition, two

environmental technology companies have expressed interest in licensing the technology. A patent application is currently being developed for this technology.

Source of Funds: Hatch, State Funds, N.J. DEP and Private Grant

Scope of Impact: State Specific

Key Theme - Sustainable Agriculture

Washington Research

1. Conservation tillage and no till protects land, air, and water resources through the STEEP and PM-10 programs.
2. Integrated pest management strategies reduce pests in conservation tillage.
3. Soil, air, and water erosion has been reduced using conservation tillage.
4. Dissemination of new technology has increased adoption of direct seeding through STEEP educational conferences, trade shows, www sites, bulletins, and case studies.

Virginia Combined Research and Extension

As a result of Virginia Cooperative Extension educational programs, research, and demonstration projects, 90 percent of the Christmas tree acreage in Southwest Virginia is now being grown with sod suppression vegetation management, which results in greater sustainability and increased profitability.

New Hampshire Extension

Sustainable agriculture education issues include regulations which impact agricultural production, issues which directly impact business profitability, identification and development of marketing education, educational programming for consumers, work with regional and local planners to help in development of natural resource plans and to provide educational help for business entry and maintenance of farm families. The program also helps protect the net income of diversified farms in event of crop or market loss. It contributes to the preservation of family farms and agricultural and natural resources. The program also attempts to improve the public image and understanding of agriculture in New Hampshire.

- g. Impact - Reduced fertilizer purchases, saving more than \$22.4 million, was the result of more effective use of manure. The reduction in nitrogen and phosphorus fertilizer applied to crop lands also decreased the potential of leaching of nutrients into aquifers. Approximately 2,800 pounds of food waste and 2,100 pounds of carbonaceous materials were composted on Star Island at the Isles of Shoal. Composting the food waste has prevented this material from being dumped into the sea. In vegetable production, education on the use of high tunnels and plastic mulches reduced the use of herbicides and the potential for pollution by up to 50 percent. Use of trickle irrigation reduced water use by approximately 50 percent as well. This means there is both less water and less energy used for pumping. Basic Integrated Pest Management (IPM) practices were employed on virtually all of New Hampshire's 3,877 acres of apples, reducing spraying significantly from pre-IPM levels. Maintaining rural character in New Hampshire is the best way to sustain agriculture. The NH Coalition for Sustaining Agriculture, which Extension coordinates, is a working group of over 20 organizations and producers. This Coalition developed a resource kit for community officials which offers insights, tools and resources to help prevent unintended negative consequences of land use regulations and decisions on agriculture. It also offers specific suggestions for enhancing and supporting agriculture. This notebook, "Preserving Rural Character Through Agriculture: A Resource Kit for Planners," has been distributed to all the towns and municipalities in New

Hampshire.

- h. Source of Funding - Smith-Lever 3b&c, Hatch Act Funds, State matching funds, County funding, grants
- i. Scope of Impact - Multi-State Extension (NH, ME, MA, VT, RI, CT, NY, PA)
 - Integrated Research and Extension (NH)

North Carolina Extension

- a. Providing educational opportunities for farm and non-farm citizens to address controversial issues related to animal agriculture including food quality and safety assurance not only sustains the NC animal agriculture industry but also provides for the production of safer food products derived from animals. In 2000, issues related to animal agriculture were addressed by Extension specialists and field faculty using several means of disseminating information including conferences, workshops, scientific meetings, radio and television shows, the WEB, magazines, newsletters, Extension bulletins, and local, state, and national newspapers.
- b. Impact - More than 5,500 farmers and 103,000 non-farm citizens improved their knowledge, understanding, attitudes, and appreciation for animal agriculture through these various educational avenues. Moreover, 4,285 farmers and 90,885 non-farmers increased their understanding of the animal food supply and quality standards and nearly 2,300 farms adopted appropriate animal agriculture standards, practices, and procedures of operation.
- c. Scope of Impact - State Specific

Florida 1890 Research

Adoption of sustainable agriculture practices enable the one hundred twenty (120) meat goat producers to reduce feed cost on an average of \$425/breeding unit and health cost on an average of \$180/breeding unit. This translates into savings of \$51,000 for feed cost and \$21,600 in health cost for 120 producers. Increased profitability improved the competitiveness of goat producers. Also increased profitability resulted in production goals and financial incentives for producers to improve breeding, feeding, health and management practices. Benefits of stakeholders include: (1) research, education and extension activities to improve animal production efficiency, agricultural profitability and competitive position of small and resource farmers positively impacted and increased the decision making skills of the end users as they go through lifelong learning, and (2) innovative collaborations and partnerships with stakeholders/end-users built sustainable solutions to agricultural and rural problems and forge partnerships for the future.

Louisiana 1890 Extension

The SUCEP agents in collaboration with the Southern University agricultural scientists are developing best management practices that minimize the use of commercial fertilizers and pesticides. The program also focuses on helping farmers who successfully produce enterprises (crops and livestock) using sustainable and organic practices to establish market outlets to include farmers' markets, roadside stands, and on-farm markets.

- j. Impact - More than 30 agricultural educators (extension agents, USDA personnel and farm leaders) gained knowledge on the concepts and principles of sustainable agriculture. The program successfully reached more than 1,800 producers, gardeners, landowners, and others with sustainable agriculture. These education efforts resulted in the following:
 - a. 10 producers started or improved a pastured-poultry operation. Four of these producers also established a direct market for their birds, thus selling them at \$3.00 to \$5.00 each, well above market price.
 - b. 45 beef cattle producers adopted soil and pasture management practices.
 - c. 30 vegetable producers adopted sustainable marketing practices through participation in their local farmers' markets.
 - d. 44 limited resource farmers and/or landowners gained knowledge on the EQIP program and the benefits to the environment.
 - e. 115 producers and homeowners gained knowledge in the safe use of pesticides.
 - f. 90 producers attended a production meeting gaining knowledge in environmental law.
- k. Source of Funds - Smith-lever- Section 1444, and grants for SARE and USDA, NRCS. The total cost of the program including salaries, fringe benefits travel, and administration is approximately \$175,000.
- l. Scope of Impact - Louisiana

Key Theme - Water Quality

Washington Research

The demonstration of the long-term improvements in water quality through alum injections and hypolimnetic oxygenation of selected lake ecosystems impacted by urban development and watershed degradation has resulted in significant improvements in two eastern Washington Lakes near Spokane, WA. This technology is now being applied to additional lakes in the area exhibiting similar problems, with the potential for additional gains through follow on research efforts.

Washington Extension

b. Impact: The collaborative effort with the Roza and Sunnyside irrigation districts indicate that 86 violators of water quality standards adopted and implemented management plans and practices, with addition of PAM technology in several cases. These practices improved the management of more than 4,000 acres of highly erodible soils and dramatically improved the water quality of irrigation return flows to the Yakima River. The implementation of these practices improved the sustainability and economic well being of irrigated farming operations by eliminating the penalties of reducing flows or cutting the water supply to those irrigators that incurred in water quality violations. Due to irrigation conversion from rill to drip or sprinkler methods and improvement of erosion control practices in rill irrigation, the trend of dramatic water quality improvement continued for the main stem of the Yakima River. For instance, the mean daily sediment flowing from Granger Drain into the Yakima River was 16 tons of sediment/day. Thus, the sediment loading decreased more than two-fold since 1999 (43 tons/day). Similarly, turbidity measurements indicated that the Granger Drain is rapidly approaching the TMDL goal of 25 NTU. Less soil loss also represents less loss of nutrients and productive soils from crop fields and reduction of DDT levels in the sediments of Yakima River.

Virginia Combined Research and Extension

A Virginia Tech Extension Specialist helped develop a network of volunteers to assist in monthly water sampling in the Page Brook watershed in Clarke County. Results from the data collected on fecal source tracking indicated that livestock were a major contributor to fecal pollution in Page Brook. As a result of this information, farmers voluntarily fenced livestock away from streams, established watering points or in-pasture water stations, and developed riparian zone vegetation along the streams. Within less than a year, populations of fecal bacteria in the stream declined by over 90%.

Tennessee Combined Research and Extension

Impact:

Use of no-till for major Tennessee crops exceeded 50% of acreage for the first time ever. No-till use in cotton reached 300,000 acres, or half of all cotton planted. The additional 300,000 acres of no-till on Tennessee cropland is estimated to reduce soil erosion by three million tons annually and to save at least 7.5 million dollars in off-site damage by sediment.

Funding Source:

Smith-Lever and State

Scope:

State Specific

Pennsylvania Extension

In Bucks County, 52 farms enrolled 3000 acres in a USDA Environmental Quality Incentive Program in the Neshaminy Creek Watershed. The Suburban Philadelphia Water Company reported that, as a result of BMP's instituted, peak spring atrazine levels dropped from 15 ppb in 1996 to 1.3 ppb in 2000.

Oregon Research

Research has shown the potential to reduce N fertilizer rates by 50 to 150 lb N per acre on hops, corn silage and peppermint. While growers benefit from lower production cost, all of Oregon's citizens benefit from groundwater protection from nitrate-N contamination.

(3) Research Outcomes

Producers of corn silage, sweet corn, hops and peppermint have all reduced N fertilizer rates as a result of this research.

North Carolina Extension

- a. Educational programs targeting the general public, businesses, and professionals were used to teach individuals about water quality, wastewater management, and watershed management. Water screening was conducted in numerous counties in conjunction with local health departments and NCSU. Demonstration projects in watershed and wastewater management provided excellent "real life" experiences for local government officials and professionals.
- b. Impact - During 2000, 19,060 people increased their knowledge and awareness of best management practices which would improve drinking water quality with 7,404 adopting one or more practices to improve drinking water quality. As a result of these efforts, it was estimated that over \$400,000 was saved due to citizens not having to replace contaminated wells or use an alternative source for water. Furthermore, 2,033 wells were protected or improved by implementing one or more water quality practices. Specifically, 610 people in counties reported that they had improved their existing wells by extending the casing above ground, regrouting it, or replacing the old casing with steel, concrete, or PVC. Approximately 1,425 people adopted practices such as not storing chemicals in the well house, not mixing or loading chemicals near the well house, or housing animals in or near the well housing to minimize well contamination. Over 1,400 people had their water tested and /or treated appropriately. Over 4,200 people adopted best management

practices to protect and improve surface and ground water. Practices included using soil tests to direct lawn and landscape management, using native or water conserving plant materials, proper automobile maintenance techniques, and proper car washing techniques. Over 250 businesses, local governments, and development professionals also adopted best management practices to protect and improve surface and ground water by using less fertilizer and pesticides, implementing erosion control practices, bio-retention practices for storm water wetlands, and initiating stream restoration work. An estimated 7,425 acres of urban and residential watershed were improved by best management practices along with 17,020 linear feet of streams.

c. Scope of Impact - State Specific

Montana Extension

Brief Description:

Extension specialist, cooperatively with Natural Resources specialist, has developed a ½ day, on-site landowner education program dealing with stream corridor and water quality monitoring. Emphasis of program is empowerment of landowners to address watershed and water quality protection issues on a watershed basis. Landowner community action groups are trained in land use impacts on water quality and water quality parameter monitoring. Workshops were conducted with 18 watershed landowner groups, involving approximately 150 individuals. Extension specialist has developed a state-wide private well water user education program involving water quality testing of private well samples, follow up education, and referral of participants to private water testing services. The program, initially conducted solely as cooperative effort with the Montana Agricultural Experiment Station, is now cooperatively conducted with the Montana Department of Environmental Health and Human Services and privately owned water testing labs. Approximately 9,500 individuals have been educated through this program, with participation averaging approximately 1,200 individuals annually. Cooperating Institutions/Organizations: Montana Agricultural Experiment Station, Montana Department of Environmental Health and Human Services, Montana Farm Bureau, private enterprise.

Impact/Accomplishments:

Eighteen landowner watershed groups have been trained in stream corridor and water quality monitoring and have access to continuous use of water monitoring equipment through county Extension offices; approximately ½ of these groups have maintained active watershed monitoring programs. Approximately 1,000 private well water users have been advised of the presence bacterial contamination in their domestic water supplies; approximately 200 private well water users have been advised of the presences of elevated nitrate-nitrogen levels in their domestic water supplies. Follow up assessments indicate that nearly 98% of these individuals have taken appropriate action, either disinfection or installation of water treatment facilities, to address these concerns.

Source of Funding:

Specialist Salary (~35% FTE to this program) - State
Other funding sources - USDA Water Quality Programming Grant

Private well water user participation
Smith Lever 3b&c
Local

Scope of Impact:
State specific

California Combined

Over 1,000,000 acres of rangeland are now covered by ranch water quality plans. These plans have resulted in significant reductions in sediment and pathogen loads in water bodies across California. These non-point source pollution reductions have resulted from improvements to grazing management, ranch road construction and maintenance, and re vegetation projects. The final result is improved water quality for a variety of beneficial uses downstream from livestock grazing operations.

Colorado Research

Short Description - Halogenated pesticides, used in Colorado and every other state, have impacted water supplies. For example, both atrazine and alachlor have been detected in ground and surface waters in Colorado at levels that exceed the drinking water MCLs. Current methods of detecting and monitoring specific compounds in waters are expensive, time consuming, and require sample removal, which can disturb the composition. An attractive option is the development of inexpensive sensors of particular agricultural chemicals that could be used in situ to monitor ground or surface waters. This project has developed an enzyme-based sensing strategy that results in fiber optic biosensors capable of detecting chlorinated organic compounds at low concentrations.

Impact - A biosensor for atrazine has been developed. The biosensor's measurements were calibrated against a traditional gas chromatographic analysis with excellent agreement (and a small fraction of the analytical time). This work is significant because no other device for inexpensive, continuous, real time, in situ monitoring of atrazine has been developed. Sensors of this type would be useful for monitoring water supplies (ground, surface, or waste water), especially if sensors for different compounds were bundled together. Since atrazine is a widely used herbicide, this biosensor is of importance to the agricultural community.

Source of Federal Funds – Hatch Act funds

Scope of Impact – State Specific

Connecticut Combined

a. Activity - Connecticut is concerned with the continued deterioration of water quality within the Quinnipiac River watershed. Pesticides and fertilizers from the farm and non-farm

industry represent potential pollutants that may influence water quality within the area as well as in Long Island Sound. IPM educational programs for 13 vegetable producers and other crops were organized to demonstrate alternative management practices, use of older pesticides with low-risk modern products, and introduce managers to new techniques to reduce nutrient and chemical use.

b. Impact - 11 farms reduced their pesticide use on 366 acres of vegetables by 70% or 44,200 pounds of active ingredient (AI). Total use of the 12 pesticides with high or moderate leaching potentials was reduced by 79% or 36,176 pounds of AI. Fertilizer recommendations were altered on 79 acres and over 4 tons of nitrogen, 10 tons phosphorus and 10 tons of potassium were eliminated from use.

c. Source of Federal Funds - Smith-Lever 3 b and c/Grants

d. Scope of Impact - State specific/CT

Missouri 1862 Extension

Twenty communities received intense education on best management practices to reduce the potential for pesticide run-off and leaching. Two cities in Northeast Missouri were able to reduce pesticide levels in the raw water from 60 ppb to 6 ppb. This resulted in each city saving more than \$30,000 a year in treatment cost to remove pesticide from the public drinking water supply. The farmers in the watersheds adopted a two-pass pesticide system of application and saved an average of \$10 per acre or more than \$14,000 each year.

Key Theme - Recycling

Oklahoma 1862 Extension

The citizens of Canadian County responded to this opportunity to "do the right thing" by delivering 938 car tires, 131 large truck tires, 60 car batteries, and 830 gallons of used oil for recycling. Our extension community development staff will take the tires to a chipping plant in Oklahoma City, which receives \$1 per car tire and \$3 per truck tire out of the state's tire indemnity fund. The batteries will be sold to a smelter to defray the expense of the roll-off boxes used to collect the tires. Used oil we recycled went to Canadian County District #1, where it will be burned to provide heat for the shop this winter. This benefits county taxpayers by saving the money that would normally go to buy gas to heat the shop. Estimated savings to the county general fund is about \$40 per day when the county uses recycled oil instead of natural gas to heat the shop.

Impact(s):

- Recycled 938 car tires, 131 truck tires, 830 gallons of oil, and 60 batteries.
- Over 1,100 tires removed from possibly ending up in roadside ditches.
- 830 gallons of used oils put to good use and kept out of groundwater resources.
- The lead from 60 car batteries recycled and kept out of the environment.

Funding Sources: Smith-Lever; State

Scope of Impact: State Specific

Mississippi Combined 1862 Research and Extension

a. Farmers across Mississippi are faced with the problem of used poly tubing and pesticide containers accumulating at their farms. Simply throwing them away is a hassle and fills landfills.

In 1996, the Mississippi State University Extension Service began a program in Quitman County to collect this poly tubing from farms. In the spring of 2000, the county received a \$12,000 grant to purchase two poly tubing reels to loan to producers and to pay the pickup fee charged by the recycler.

b. Previously, the county recycled about 140,000 pounds of poly tubing and 20,000 pounds of pesticide containers. The loaner reels can increase poly tubing collections to 300,000 pounds a year, resulting in a \$6,000 saving to farmers in Quitman County. Recycling the poly tubing also improves the appearance of farms and helps the county reduce wastes headed to the landfill.

c. Smith-Lever funds

d. State-specific

Key Theme - Composting/Yard Waste

Washington Extension

b. Impact: Besides reporting increased knowledge in composting, moisture problems, radon, and other potential indoor pollutants, insulation, air leakage and duct problems, 50% of the participants planned at least one behavior change. These changes included testing for CO and radon, controlling humidity levels in their homes, learning more about native and drought tolerant plants, mowing less frequently, mulching, and composting.

As a result of the semi-annual compost demonstration programs and the Green Zone Open House, there was compost bin distribution to 366 Spokane County residents. Ninety-six individuals completed evaluations during the Green Zone open house. Participants reported knowledge gain in a number of areas including 41% in composting, 30% in grasses and alternatives to turf for lawns, and 7% in energy savings. When asked about changes they intend to make, respondents listed 39% will add composting and worm boxes, 22% will add more grasses to garden areas, 20% will save water, plant drought tolerant or native plants, 90% will use energy saving lights, and 7% will reduce garbage and recycle more.

Key Theme - Wildlife Management

Utah Combined Research and Extension

Brief Description: Extension specialists developed a comprehensive program to improve the management of wildlife and their habitats on private land in Utah. The Cooperative Wildlife Management Association Program (CWMA) constitutes an annual Extension and training sessions for private landowners and operators that participate in Utah's Cooperative Wildlife Management Unit (CWMU) program. The CWMA is a 501 c (6) non-profit business organization incorporated under the laws of the State of Utah. CWMA members pay an annual \$100 membership fee. These fees are used by Extension specialists to conduct two annual meetings and workshops on topics of interest to program participants and to maintain periodic correspondence.

Impacts: In 2000, the CWMA had 64 CWMUs as members. These units consisted of over 300 private ranches totaling over 1.7 million acres of private rangelands in Utah. Since inception of the CWMA, the program has saved Utah CWMU operators over \$4.5 million dollars and resulted in improved habitat and range conditions on over 300,000 acres.

Source of Funds - State wildlife agency, private landowners, and the S.J. and Jessie Quinney Foundation.

Key Theme - Agricultural Waste Management

South Carolina 1862 Extension

There were 6 activities and programs conducted to increase the adoption of nuisance prevention practices with livestock producers. In addition, an entire chapter of the Confined Animal Manure Management training manual deals with controlling vectors such as flies and rodents.

b. Impacts –

A total of 330 producers were reported to have completed non-formal educational programs involving nuisance prevention. Of these, 35 participants reported an increase in knowledge and 33 indicated they have adopted best management practices to reduce rodent and fly populations on animal production farms.

c. Source of Federal Funds – Smith Lever 3b&c

d. Scope of Impact – State

Key Theme – Wildfire Science and Management

Nevada Combined Research and Extension

- a. In collaboration with other agencies, Cooperative Extension and the Experiment Station conducted a project to evaluate the effectiveness and practicality of controlled sheep grazing. The sheep were brought in to create a fuel break along the urban-wildland interface of Carson City, Nevada on C-Hill, an area known for its propensity to burn. Three hundred and fifty ewes grazed a 200-foot wide, 2.5-mile long corridor divided into 20 mini-pastures for one month in the spring and fall.
- b. **IMPACT:** The sheep reduced the amount of wildfire fuel from 700 to 2,000 pounds per acre, depending upon the treatment. In addition, 71 to 83 percent of fine fuels, which burn easily, was removed; the height of fine fuels was cut reducing the length of flames during fires; and cheatgrass was trampled, also reducing the fire hazard. Nearly 90 percent of adjacent homeowners supported the project and preferred the sheep to other methods of creating fuel breaks. The results indicate that controlled sheep grazing is an effective and acceptable tool to create fuel breaks along the urban-wildland interface. The “ewes” story received national media coverage including a story by Paul Harvey, an article by nationally syndicated columnist Baxter Black, articles in numerous major newspapers and more than 19 stories in local newspapers. The sheep grazing project will be expanded to other areas in western Nevada under a separate program.
U.S. Senator Richard Bryan was quoted in a *Reno Gazette-Journal* article saying, “Your sheep are getting national attention.” An editorial in the same newspaper stated, “These are the kinds of innovative ideas that will help us better manage our area.”
- c. **Source of Funds:** Smith-Lever & State Matching Funds
NAES State Funds
- d. **Scope of Impact:** State Specific, Integrated Research and Extension

Key Theme - Weather and Climate

Nebraska Research

Impact Statement: Drought Monitor

(Relates to Goal IV, Output Indicators 5 & 6, and Outcome Indicators 1 & 2)

Issue: (Who cares and why?)

Drought plagues at least 10 percent to 18 percent of the nation annually, costing \$6 billion to \$8 billion. While it is the costliest natural disaster, drought's slow, creeping nature makes it hard to predict and monitor, which is important for reducing its catastrophic effects.

What has been done?

University of Nebraska researchers at the National Drought Mitigation Center helped develop and now maintain a new nationwide drought tracking system, called the Drought Monitor. Launched in August 1999, this web-based monitor combines several drought and water indices in a single, simple, colorful map showing where drought is emerging, lingering or subsiding nationwide. Frequent updates highlight emerging trouble spots so state and federal officials can take steps to reduce drought's impacts. NU Institute of Agriculture and Natural Resources researchers collaborated with USDA and the National Oceanic and Atmospheric Administration on this project, which is the first to consolidate scientific data from numerous sources into a single, simple format.

Impact:

The Drought Monitor fills a nationwide need for timely, user-friendly information to improve drought tracking and to characterize its severity. It's estimated that more than a million people used the monitor in its first year. Major media nationwide, including The Weather Channel, use the monitor in some form. While it was primarily designed for drought and water planners, the monitor's wide use and simple format are increasing public awareness of drought. Alabama, Florida, Georgia, Oklahoma, Nebraska and South Carolina are among numerous states using the Drought Monitor in some form to better monitor, plan and respond to drought.

Funding:

USDA

National Drought Mitigation Center

NU Agricultural Research Division

Hatch Act

Summary:

A new drought tracking system that University of Nebraska researchers helped develop is improving drought monitoring nationwide. Institute of Agriculture and Natural Resources scientists at the NU-based National Drought Mitigation Center teamed with scientists at two federal agencies to develop the Drought Monitor, an easily understood, web-based tool for tracking widespread drought. The monitor combines information from several drought and water indices in a single map showing where drought is emerging, lingering and subsiding. It highlights emerging trouble spots so state and federal agencies can work to reduce drought's impacts. Launched in 1999, it's estimated that more than a million people used the monitor in its

first year. State and federal agencies use the monitor in their drought planning and response efforts.

Key Theme - Hazardous Materials

Nebraska Research

Impact Statement: Cleaning Up Pesticide-Contaminated Soil

(Relates to Goal IV, Output Indicator 2, and Outcome Indicator 3)

Issue: (Who cares and why?)

Pesticides help farmers grow abundant crops, but chemical spills can contaminate soil and groundwater, threaten the environment and cost millions to clean up. University of Nebraska scientists devised a simple, low-tech and low-cost way to clean up soil contaminated with pesticides.

What has been done?

Their simple method involves mixing iron and water into pesticide-contaminated soil. Iron is the key. It shows the potential to quickly, effectively attenuate a variety of pesticides. The NU Institute of Agriculture and Natural Resources technique involves windrowing soil with earth-moving equipment and mixing it with a high-speed soil mixing and fracturing implement. Iron particles and water are added during mixing. Windrows are covered with plastic sheeting and kept moist for three months. This technique eliminates up to 95 percent of the contamination, allowing once-toxic soil to be returned to the ground. This approach is adaptable to many contamination situations, uses readily available material and equipment and can be easily taught to almost anyone.

Impact:

This method is up to 95 percent effective in removing pesticide contamination from soil. Researchers believe more pesticide spills may be reported if business owners know simple, economical and environmentally safe cleanup methods are available. Using iron to treat contaminated soil can cost as little as \$30 dollars per cubic yard compared with more than \$600 per yard with current cleanup methods that usually involve removing, transporting and incinerating soil. During successful field tests, researchers helped a southwest Nebraska company decontaminate soil from an herbicide spill five years earlier. Cleanup using the NU technique cost \$62,500, compared with a potential cost of more than \$604,000 had the soil been transported and incinerated.

Funding:

NU Agricultural Research Division

Hatch Act

U.S. Geological Survey water resources research grant

UNL Water Center

Summary:

Current soil decontamination techniques can cost millions of dollars. Institute of Agriculture and Natural Resources researchers have developed a simple cleanup technique that involves mixing iron particles and water into pesticide-contaminated soil. This method shows potential to quickly and cost-effectively clean up a variety of pesticides and allow once-toxic soil to be returned to the ground. This technique uses readily available materials and equipment, and the methods can

be easily taught to almost anyone. Using iron to decontaminate soil can cost as little as \$30 dollars per cubic yard compared with more than \$600 per yard for current methods that usually involve removing, transporting and incinerating soil. During successful field tests, researchers helped a southwest Nebraska company decontaminate soil from an herbicide spill five years earlier. Cleanup using the NU technique cost \$62,500, compared with a potential cost of more than \$604,000 had the soil been transported and incinerated.

Mississippi Combined 1862 Research and Extension

a. Unused pesticides accumulate on farms, creating a potential danger to the environment. Mississippi does not have a facility licensed to dispose of hazardous wastes such as pesticides and disposing of these is expensive.

In an effort to protect the environment and eliminate these unused chemicals in part of the state, the Mississippi State University Extension Service held a waste pesticide collection in Sunflower County in conjunction with two environmental agencies. The cost of disposal was covered through a grant from the state Department of Environmental Quality. Eighty-six farmers from 22 primarily Delta counties brought 150,159 pounds of unusable crop chemicals to the collection site.

b. The event, the 40th of its kind in the state since 1994, saved Mississippi farmers more than \$165,000 in disposal costs. Since 1994, these collections have safely disposed of almost 1 million pounds of pesticides. Organizers say the turnout shows that farmers truly care about protecting the environment.

c. Smith-Lever funds

d. State-specific

Key Theme - Natural Resource Management

Nebraska Research

Impact Statement: Commercializing Remote Sensing

(Relates to Goal IV, Output Indicator 7, and Outcome Indicators 2 & 4)

Issue: (Who cares and why?)

Remote sensing and related technologies are powerful tools for assessing natural and human-made environments but have been too costly for private companies to pioneer.

What has been done?

The University of Nebraska's Center for Advanced Land Management Information Technologies collaborates with NASA on an economic development venture to develop commercial applications for remote sensing, global positioning systems, geographic information systems and related technologies for the Great Plains. The program works with companies to adapt these technologies to a specific application a participating company identifies. In one recent promising project, center staff evaluated the potential for remotely verifying tillage practices that store carbon in crop residue. This work was for a company that helps farmers sell carbon-storage credits to industry. Other recent successes involved remotely detecting nutrient deficiencies in corn in a genetics project and creating a digital map of agricultural ecology linked to a web-based tool to support crop choices.

Impact:

This program is developing practical commercial uses for spatial information technology and saving money for companies as they learn to use it. For example, verification of carbon-storing tillage practices is crucial to companies seeking to trade carbon credits. Using remote sensing to verify residue cover reduced costs 50 percent compared with doing so in person. Farming practices that reduce atmospheric carbon, which contributes to global warming, might provide participating farmers with 75 cents to \$1.25 per acre annually if they maintain at least 30 percent residue cover on crop ground. If 25 percent of the nation's farmers with such cover sold credits at \$1 per acre, it would generate about \$27 million annually in added income on those 109 million acres.

Funding:

NU Agricultural Research Division

NASA

NU Center for Advanced Land Management Information Technologies

Hatch Act

Summary:

A collaboration between NASA and University of Nebraska researchers puts remote sensing and related technologies into the hands of private companies. Technology that otherwise would be too expensive for companies to develop is pioneered by NU's Center for Advanced Land Management Information Technologies in cooperation with private company partners. In one recent promising project, center staff evaluated the potential for remotely verifying tillage practices that store carbon in crop residue for a company that helps farmers sell carbon-storage

credits to utilities and other companies. Remote sensing cuts verification costs in half compared with visiting the site for verification.

Key Theme - Pesticide Application

North Carolina Research

Tomato foliar diseases have long been an important limiting factor to North Carolina's \$20 million fresh market tomato industry. In the past, tomato growers sprayed their crops with protectant fungicides every 4 to 5 days to prevent diseases such as early blight, late blight and Septoria leaf spot. Without fungicide applications, diseases can cut the value of tomato crops in half. But protecting tomatoes meant spraying them with fungicides as many as 25 times during the growing season. NCSU researchers and extension specialists located at the Mountain Horticultural Crops Research and Extension Center at Fletcher have been searching for ways to reduce the heavy use of fungicides on tomatoes on two fronts. New fungicide chemistries that provide better control of tomato foliar disease have been evaluated while plant breeders are working to develop new tomato varieties with multiple disease resistance that require less fungicide to produce healthy crops. One new fungicide in particular has been shown to improve disease control, especially of early blight, and spray schedule strategies were developed that integrated this fungicide with other fungicide materials, allowing applications at 7-10 day intervals. Considerable progress has also been made in developing new varieties that combine high levels of late blight resistance from wild tomato species with existing early-blight-resistant tomato varieties.

- e. Impact - This research has already reduced total fungicide usage by North Carolina tomato growers by at least 25 percent. With the introduction of future multiple disease-resistant tomato varieties, fungicide usage can be expected to be reduced by more than 50 percent.
- f. Source of Funds - Hatch, State and Smith-Lever
- g. Scope of Impact - Regional

North Carolina Extension

a. The Pesticide Certification and Licensing Program provides a direct link between NCCES and North Carolina's farmers. North Carolina private pesticide applicators are required to renew their certification every 3 years in order to use restricted-use pesticides in their farming, nursery or greenhouse operations. A new training curriculum developed by the Pesticide Education Specialists was implemented in 2000. The program covers worker protection and record keeping, calibration, pesticides and human health, proper pesticide use, and the Food Quality Protection Act through a variety of scripted slide sets, fact sheets, videotapes, and other educational materials. Specialists from 5 departments within (the NCSU) College of Agriculture and Life Sciences were brought together to complete this program. County Pesticide Coordinators are given the freedom to choose a slide set or videotape from at least two of the five general topic headings noted above. To maintain a strong partnership with the Pesticide Section of the North Carolina Department of Agriculture and Consumer Services, the coordinators are encouraged to call on local pesticide inspectors to present the training on worker protection and record keeping. After its first full year of implementation, many Extension agents have communicated the impact this program has had in making their work much easier and on their audience's high interest level in the subject matter. This program will have a (great) impact on the private applicator's perception of pesticide training by the (NCCES).

- b. Impact - The (NCCES) provides pesticide training for both private applicators and commercial applicators. Commercial applicators are those pesticide users who receive

financial compensation for their services, e.g. landscapers, utility rights-of-way managers, etc. There are 13,109 commercial applicators in NC. Of these, 1,836 were newly certified in 2000. The Extension Service conducts two-day Pesticide School throughout the state to prepare prospective commercial applicators for the certification exam. Over 1,300 people attended these schools in 2000. Commercial applicators may obtain continuing certification credits by attending training sessions sponsored by the Extension Service and other agencies. The number of applicators attending these sessions was 1,811. The total number of private applicators is 24,186. Of these, 601 were newly certified last year. Private applicators that were re-certified through the program described in the preceding paragraph numbered 7,229.

c. Scope of Impact - State Specific

California Combined

PEP's train-the-trainer programs illustrate that it is possible to leverage the efforts of a few staff in order to reach large numbers of people. In 1999, 247 participants were surveyed to assess the effectiveness of the train-the-trainer workshops; on average, each instructor trained 219 fieldworkers (SD = 670) and 35 pesticide handlers (SD = 8).

The state's Pesticide Illness Surveillance Program reports that pesticide handlers and agricultural field workers may be changing their behaviors. From 1989 through 1998, the state program, which relies on health care worker reports, found that topical illnesses definitely or probably caused by pesticide exposure dropped by 61% in agricultural workers and 57% in nonagricultural workers.

Key Theme - Forest Crops

North Carolina Extension

- a. The main theme of Cooperative Extension Major Program 10, Forest Products Manufacturing is to increase the competitiveness and profitability of North Carolina's wood products industry, improve markets, and increase consumer understanding of wood products and their proper use. To meet this goal, faculty conducted, organized, or participated in 145 workshops, conferences, seminars, short courses, and classes for forest industry and consumer audiences.
- b. Impact - These efforts reached an estimated 3,333 individuals. An additional 50,000 individuals were reached via referred publications, brochures, reports, pamphlets, non-refereed publications, computer software, popular press articles, and the web. These activities resulted in 63 firms adopting new manufacturing techniques, 142 consumers adopting practices related to the selection, use, and maintenance of wood products, 2,043 individuals increasing their knowledge of the economic importance of the wood products industry, and 10,697 consumers increasing their understanding of forest products and their proper use. In economic terms these activities resulted in the following impacts: \$9,600,000 saved through improved utilization or productivity; \$1,400,000 in increased production of value-added products; and \$3,156,000 saved through improved yield, efficiency, and marketing.
- c. Scope of Impact - State Specific

Key Theme - Soil Erosion

North Carolina Extension

- a. Soil erosion continues to be a major concern in North Carolina, since it has both on-site impacts (loss of fertility, gullyng, disruption of normal tillage operations) and off-site impacts (loss of aquatic habitat, pesticide and nutrient pollution, sedimentation in sensitive areas). Extension is working with other state and federal agencies to educate farm and non-farm communities about erosion control and stream bank stabilization. These efforts not only help keep the soil in place, but also improve water quality and recreational opportunities downstream.
- b. “Many individuals perceive agriculture to be the number one polluter of water resources. Strip and no-tillage are one of several tools that can reduce the amounts nutrients entering surface waters. As a result of collaborating with the Soil and Water Conservation District, 10 Ag Cost Share farmers planted 2800 acres of Strip Till and/or No-Till cotton. They prevented 172,000 pounds of Nitrate and 2400 pounds of phosphate from leaving their fields. Soil erosion was reduced by 17,000 tons.”
- c. State Specific

Key Theme - Air Quality

Louisiana Combined

Prescribed burning as a harvest management tool in sugarcane is a widely used practice. There are numerous environmental and public issues associated with this practice. In response, a voluntary smoke and ash management program to assist growers in addressing these issues has been instituted. Additionally a number of research projects are under way to address possible remedies to cane burning. Smoke and ash management can be defined as conducting a prescribed burn during recommended weather conditions using burning techniques to lessen the impact of smoke and ash on the environment, public health and welfare. Application of these guidelines minimizes concentrations of smoke and ash in sensitive areas and assists in maintaining air quality standards. The Certified Prescribed Burn Manager (CPBM) program is administrated by the Louisiana Department of Agriculture and Forestry. The Louisiana Department of Agriculture and Forestry (LDAF), the American Sugar Cane League and the LSU AgCenter developed the *Louisiana Smoke Management Guidelines for Sugarcane Harvesting* and the LSU AgCenter provided training and program information for growers. The main collaborators were the Louisiana Department of Agriculture and Forestry, the American Sugar Cane League and the LSU AgCenter who acknowledge the additional assistance provided by the Office of Soil and Water, (LDAF) and Forestry, the Office of Forestry, (LDAF), the Environmental Science Division, Louisiana Cooperative Extension Service, the Florida Sugar Cane League, the USDA Forest Service and the National Weather Service in preparing the program guidelines.

- c. There were nine training sessions during the summer of 2000 in the 23 parish sugarcane growing area. As a result of the trainings, 1,375 growers were certified as Prescribed Burners. During this years' harvest season, there was a 90% decrease in smoke and ash complaints to the Department of Agriculture. The decrease in complaints have been directly attributed to the smoke management trainings.
- d. **Source of funds** - Smith-Lever 3b+c
- e. **Scope of impact** - State only